Technical Release
64

Floodway Determination Computer Program

Soil Conservation Service

United States Department of Agriculture

Engineering Division

Preface

This technical release was prepared by hydraulic engineers from the Soil Conservation Service (SCS) Central Technical Unit, Glenn Dale, Maryland. It was approved by personnel of the SCS Engineering Division, Washington, D.C., and the SCS regional technical service centers.

The Floodway Determination (FLDWY) computer program is used to determine the floodway for flood hazard and flood insurance studies. It is a revision of and replacement for previous HUD-15 programs.

This technical release contains user instructions for the FLDWY program. It will assist engineers in preparing the input and in interpreting the results.

Issued June 1978

Floodway Determination Computer Program

Introduction

The SCS Floodway Determination (FLDWY) computer program is used to calculate a floodway at given cross sections along a stream. For this program a floodway is defined as the minimum width at a cross section that is required to carry the selected (generally 100-year) flood with a specified increase in the water surface elevation. The procedure in the program is based on the equal conveyance reduction concept. No encroachment or narrowing of the channel is allowed. For multiple channels, any overbank segment between channel segments is considered part of the channel. This program does not compute floodways at road sections.

Before FLDWY can be used, the elevation of the selected flood at each cross section must be known. The input data for WSP2,[1] Upper Darby (U.D.)[2] and WSPIN[3] water surface profile (WSP) programs can be used directly by FLDWY to make floodway calculations. This feature eliminates the need for repunching cards that were punched for these programs. The entire data decks are read, but only the cross-section and segment data are used in the computations. If the data have not been processed by one of the WSP programs, the cross-section and segment data must be punched in WSP2 format for processing by FLDWY.

FLDWY is a revision of the SCS HUD-15 computer program and replaces all versions of HUD-15. FLDWY was changed to allow (1) use of the last data point in the cross section when the maximum number of data points is used, (2) use of a channel as the leftmost segment of a cross section, (3) reordering of WSP2 cross-section data according to transverse distance, (4) use of multiple n-values in WSP2 data (only the first n-value of each segment was used in the HUD-15 programs), (5) use of WSP2 decks without the restriction that segment data precede section data, and (6) printing of the input data used in the computations.

Method of computation

Although the method of computation has not been changed, in this section it is outlined to give the user a basic understanding of how the calculations are made and to help in interpreting the output. The method is not described in detail in this document. For a detailed description of the method see TSC Advisory RB-UD-1.[4]

Equal conveyance reduction means that, as the water surface elevation changes at a cross section, the friction slope is assumed to remain the same or, in other words, the

[1] USDA, SCS, TR-61, WSP2 Computer Program, May 1976.

[2] USDA, SCS, NETSC Technical Note MGT-3, Attachment #3, May 1968.

[3] USDA, SCS, Fort Worth ADP Unit Technical Note 1, Automatic Data Processing Users Guide, Attachment 1, January 1975.

[4] USDA, SCS, NETSC Advisory RB-UD-1 and Attachment, May 6, 1971.

change in velocity head is assumed to be negligible. As long as this assumption holds, the calculations will be accurate.

The floodway calculations are based on conveyance (KD) values in the segments of a cross section. The KD in the channel segment is computed for the selected flood elevation and for the increased elevation for which the floodway is being computed. The KD values in the left and right flood-plain segments are computed only for the selected flood elevation. In determining the floodway, the KD values of the left and right flood plains are both reduced by one-half of the increase in the channel KD. The floodway width is computed by starting at the channel banks and moving the floodway boundaries out until the reduced KD value in each flood plain is satisfied. The outer boundaries of the floodway are assumed to be vertical and to have the same n-values as the segments in which they fall.

If the n-value varies with the hydraulic radius in WSP2 data, the floodway elevation is used with the original cross section to calculate the hydraulic radius of each segment. The hydraulic radii are used to select the n-values for the floodway calculations. The selected n-values are used regardless of any change in hydraulic radius caused by the location of the floodway boundaries. The same procedure is used for each floodway elevation.

Situations exist when the channel can carry the entire flow at the increased elevation or when no flow area or KD is needed in one of the flood plains. These conditions are noted on the output under OUTPUT MESSAGE.

To check the assumption that velocity head changes are negligible, the change in velocity head between the initial flood elevation and the floodway elevation is printed on the output. The velocity is followed by a C if it equals or exceeds critical velocity. If the change in velocity head is large in relation to the increase in elevation, results may not be accurate. Trial and error runs with a WSP program may be needed to obtain accurate results in these cases.

Input

The FLDWY program input consists of four types of header cards:

1. Identification card. This identifies the program with which the data are to be processed and the format of the cross-section data.
2. TITLE card (optional). This card gives any desired title information.
3. OPTION card. This card is required only for changing the default values of any or all options.
4. DOSECTION cards. One card is required for each cross section for which floodway computations are desired. These cards do not have to be in any specified order, because the computations are performed in the order of the sections in the WSP data deck. Decimals are not required in the data fields if elevations and discharges are expressed in even feet. For example, a decimal would not be required for 400 but would be required for 400.5.

Exhibit 1 gives the format and the order for the header cards. The required data can be entered anywhere in the columns specified.

The header cards are followed by either the WSP2, U.D., or WSPIN data deck as indicated on the identification card. No modification of the U.D. or WSPIN decks is required. The only restriction on the WSP2 data is that SECTION and SEGMENT data for each cross section must follow each other. It does not matter which is first, and the order does not have to remain the same throughout the deck.

Columns	Information required	Remarks
1. Identification		
1 to 10	FLDWY	Program name must be in these columns.
11 to 20	WSP2 or U.D. or WSPIN	One of these formats for input data must be specified.
2. TITLE		This card is optional.
1 to 10	TITLE	Must be in these columns.
11 to 80		Any alphanumeric title information.
3. OPTION		Used only if default specifications are to be changed.
1 to 10	OPTION	Must be in these columns.
11 to 20	YES or	A list of the input used in the calculations is printed. This is the default specification.
	NO	No list of input is printed.
21 to 30		Leave blank. Reserved for future use of punch option.
31 to 35 36 to 40 41 to 45		Stage in feet above the flood elevation used for floodway computations. Default values are 0.5, 1.0, and 2.0 feet. New values can be inserted to replace any or all default values. The values must be inserted from smallest to largest.
4. DOSECTION		Maximum of 99 cards. A DOSECTION card is required for each section to be computed.
1 to 10	DOSECTION	Must be in these columns.
11 to 20		The section name for which the floodway is to be computed. This name must be identical to that used in the cross-section data.
21 to 30		Elevation of the selected flood at the section, in feet.
31 to 40		Discharge for the selected flood at the section, in cubic feet per second.
41	1	To indicate the last DOSECTION card. Leave blank on all other DOSECTION cards.

Exhibit 1.--FLDWY header cards.

There is no checking of the input data as is done by WSP2. These data should have been run on a WSP program before being used in FLDWY.

No special end-of-run cards are required. The program terminates when the computations for all DOSECTION cards are complete.

Output

The program output consists of:
1. A header sheet that gives brief information on the method, the required input, and an explanation of the output messages.
2. The computations for the selected flood elevation (current conditions) and three elevation stages above this selected flood elevation.
3. An optional 80-80 listing of the input cards that were used in the floodway computations. For example, only the SECTION, SEGMENT, and NVALUE cards that correspond to the DOSECTION card names will be listed from a WSP2 input deck. All other cards will be ignored and will not be listed.

Error Messages that are used and their causes are:
1. **ERROR** FIRST CARD NOT A PROPER IDENTIFICATION CARD. FLDWY was not in the first 10 columns of the first card. Processing terminates.
2. **ERROR** INPUT DATA NOT PROPERLY IDENTIFIED. The input type--WSP2, WSPIN, or U.D.--was not identified in the second 10 columns of the first card. Processing terminates.
3. **ERROR** PROGRAM EXPECTED DOSECTION CARD. This message appears when (1) the first DOSECTION card is not in proper sequence, (2) other data are mixed with DOSECTION cards, or (3) the numeral 1 that should have been entered in column 41 of the last DOSECTION card was omitted. Processing terminates.
4. **ERROR** NUMBER OF SEGMENTS NOT EQUAL TO BOUNDARIES FOUND IN SECTION XXXXXX. This message is used with U.D. and WSPIN input. It indicates that the number of segments specified did not equal the number of segment boundaries in the data. The section is ignored, and processing continues.
5. **ERROR** TOO MANY POINTS IN CROSS SECTION XXXXXX. DATA ON ABOVE CARD IGNORED. This message appears only with the input listing option. It means that more than 48 cross-section points were read in WSP2 format. Only the first 48 are used; the rest are ignored. Processing continues.
6. **ERROR** TOO MANY POINTS IN CROSS SECTION XXXXXX. YY POINTS ON ABOVE CARD USED. This message also appears only with the input listing option. It means that more than 72 cross-section points were read on U.D. or WSPIN format. Extra points are ignored. Processing continues.

Assembly language routines

Two assembly language routines are used with the FLDWY program: DATE and REREAD. DATE is used to obtain the current date from the computer. The execution date of the program appears on the output as XEQ date. REREAD allows the same input card to be read in different formats. This permits greater flexibility in the input data. REREAD requires a dummy unit 12 in core for reading, writing, and rewinding.

Both DATE and REREAD are IBM 360 and 370 assembly language routines; however, non-IBM computers have similar routines.

Job control language (JCL) cards

The JCL cards necessary to run the FLDWY program with the FORTG compiler are shown in exhibit 2. Similar JCL cards can be used with the FORTH compiler; the FLDWY program has been run with both.

Computation time

The computation time required per cross section is about 0.3 second on the IBM 370/168 computer.

Example

The sample job in TR-61 is used as the input for this example.

The fourth computed water surface profile was chosen as the selected flood. Exhibit 3 shows the input header cards for the FLDWY program. The program identification card indicates that the data are to be processed by FLDWY and are in WSP2 format. The data are identified by the TITLE card. The OPTION card requests that the input data be printed and the floodways be computed for elevations of 0.1, 0.4, and 1.0 foot above the given flood elevation. The six DOSECTION cards specify the cross sections for which floodway calculations are to be made and give the selected flood elevation and discharge for each section.

Exhibit 4 is the output from the FLDWY runs of these data. The discharge for cross section T1S1 was set very high to illustrate velocities equal to or greater than critical.

```
//JOBCARD
//STEP1 EXEC FORTGCLG,REGION.GO=128K
//FORT.SYSIN DD *                SOURCE DECK FOLLOWS
             ******
            *      *
            *******
/*
//LKED.SYSIN DD *                REREAD AND DATE OBJECT DECKS FOLLOW
             ******
            *      *
            *******
/*
//GO.FT12F001 DD DUMMY,DCB=BLKSIZE=80
//GO.FT08F001 DD DSN=&&TEMP,UNIT=SYSDA,DISP=(NEW,DELETE),
//  DCB=(RECFM=FB,BLKSIZE=840),SPACE=(840,(2000,10),RLSE)
//GO.FT07F001 DD DUMMY
//GO.FT06F001 DD SYSOUT=A
//GO.SYSIN DD *                  DATA DECK FOLLOWS
             ******
            *      *
            *******
/*
//
```

Exhibit 2.--Job control language (JCL) cards required to run FLDWY.

SCS-MGT-1
REV. 5-70
(FORMERLY SCS-287)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STANDARD 10 COLUMN INPUT DATA

FLDWY EXAMPLE (JOB OR PROJECT) BY H.C.T. CHECKED DATE

Control Word	Data Fields 1	2	3	4	5	6	Card Ident.
FLDWY	WSP2						
TITLE	YANTIC RIVER WS 4TH PROFILE			(USES WSP2 TR-61 TEST DECK)			
OPTION	YES		0.1 0.4	1.0			
DOSECTION	93600	102	20363				
DOSECTION	93147	102.4	20338				
DOSECTION	92397	102.8	20318				
DOSECTION	92100	102.5	20308				
DOSECTION	90963	106.3	20286				
DOSECTION	TIS1	102.6	78900	1			

Key Punch Operator: This Form Set Up For 10 - Column Skip With Exceptions As Noted. Left Justify Data In Open Fields.

PAGE _____ OF _____

Exhibit 3.--Input coding sheet. For this example, the cards are followed by the WSP2 TR-61 test data.

FLDWY REV 12/01/77
XEQ 04/05/78

USDA-SCS FLDWY PROGRAM
CENTRAL TECHNICAL UNIT
269 FEDERAL BUILDING 1
HYATTSVILLE,MD 20782

METHOD: THE ASSUMPTION IS FRICTION SLOPE DOES NOT CHANGE BY INCREASING THE FLOOD ELEVATION. THIS IMPLIES THAT VELOCITY HEAD CHANGES AT A GIVEN SECTION ARE NEGLIGIBLE. BY RAISING THE WATER SURFACE SOME DELTA ELEVATION, THE CHANNEL CONVEYANCE IS INCREASED AND THE FLOOD-PLAIN CONVEYANCES CAN BE REDUCED. THE CONVEYANCE(KD) IN EACH FLOOD PLAIN IS DECREASED BY ONE-HALF OF THE INCREASE IN CHANNEL KD OR BY THE TOTAL FLOOD PLAIN KD, WHICHEVER IS LESS.

INPUT: THE PROGRAM WILL ACCEPT INPUT IN THE SAME FORMAT AS THE SCS WSP2, UPPER DARBY WSP, OR THE WSPIN PROGRAMS WITH THE EXCEPTION THAT IN A WSP2 DECK THE SECTION DATA MUST IMMEDIATELY PRECEDE OR FOLLOW THE SEGMENT DATA FOR EACH CROSS SECTION. A FLOOD (GENERALLY 100-YR) ELEVATION AND DISCHARGE ARE REQUIRED FOR EACH CROSS SECTION.

OUTPUT: THE OUTPUT IS GIVEN BY STAGE ABOVE THE INPUT FLOOD ELEVATION. A STAGE OF 0.0 IS THE GIVEN FLOOD CONDITION, A STAGE OF 0.5 IS 0.5 FT ABOVE THE GIVEN FLOOD CONDITION AND SO ON. THE V AVG (AVERAGE VELOCITY) IS COMPUTED AS DISCHARGE/AREA. V AVG EQUALS OR EXCEEDS THE CRITICAL VELOCITY WHEN FOLLOWED BY C. THE CHANGE IN VELOCITY HEAD BETWEEN THE 0.0 STAGE ELEVATION AND THE FLOODWAY ELEVATION IS GIVEN IN THE DELTA V**2/2G COLUMN. THE OTHER COLUMNS ARE SELF EXPLANATORY. FIVE OUTPUT MESSAGES ARE USED:

1. FLOW IN CHANNEL -- THE CHANNEL CAN CARRY THE DISCHARGE. IF THE ELEVATION AT THE GIVEN STAGE IS ABOVE THE NATURAL CHANNEL BANKS, THE SIDES OF THE CHANNEL ABOVE THE NATURAL BANKS ARE ASSUMED TO BE VERTICAL AND HAVE THE SAME MANNINGS N-VALUE AS THE NATURAL CHANNEL.
2. FLOW IN CHANNEL W/O FRIC -- THE CHANNEL CAN CARRY THE DISCHARGE, BUT THE VERTICAL SIDES ABOVE THE NATURAL CHANNEL BANKS ARE ASSUMED TO FRICTIONLESS. THIS IMPLIES THAT THE FLOOD PLAINS WOULD NOT BE FILLED IN BUT COULD BE INUNDATED BY WATER HAVING NO VELOCITY IN THE DIRECTION OF FLOW.
3. NO KD IN LEFT F.P. -- ONE-HALF OF THE INCREASE IN KD OF THE CHANNEL IS GREATER THAN THE KD OF THE LEFT FLOOD PLAIN. THE VERTICAL SECTION BETWEEN THE LEFT CHANNEL BANK AND THE LEFT FLOOD PLAIN IS ASSUMED TO BE FRICTIONLESS.
4. NO KD IN RIGHT F.P. -- SAME AS ABOVE, BUT IT APPLIES TO THE RIGHT FLOOD PLAIN.
5. SURVEY DATA EXCEEDED -- THE 0.0 STAGE ELEVATION EXCEEDS THE LOWER END POINT OF THE CROSS-SECTION DATA. VERTICAL EXTENSION ABOVE THE END POINTS IS USED TO COMPUTE INITIAL KD AND AREA.

Exhibit 4.--Output from FLDWY program.

FLDWY REV 12/01/77
XEQ 04/05/78

YANTIC RIVER WS 4TH PROFILE (USES WSP2 TR-61 TEST DECK)

SECTION 93600

CHANNEL BANKS AT STATIONS -165. AND -50. DISCHARGE= 20363. CFS

STAGE	FLOODWAY STA LEFT	FLOODWAY STA RIGHT	WIDTHS IN FT. LEFT	WIDTHS IN FT. CHANNEL	WIDTHS IN FT. RIGHT	TOTAL	ELEV	AREA	V AVG	DELTA V**2/2G	OUTPUT MESSAGE
0.0	-732.	621.	567.	115.	671.	1353.	102.0	10784.	1.89		
0.1	-570.	529.	405.		579.	1099.	102.1	10061.	2.02	0.01	
0.4	-502.	479.	337.		529.	981.	102.4	9640.	2.11	0.01	
1.0	-419.	394.	254.		444.	813.	103.0	8968.	2.27	0.02	

SECTION 93147

CHANNEL BANKS AT STATIONS -197. AND -100. DISCHARGE= 20338. CFS

STAGE	FLOODWAY STA LEFT	FLOODWAY STA RIGHT	WIDTHS IN FT. LEFT	WIDTHS IN FT. CHANNEL	WIDTHS IN FT. RIGHT	TOTAL	ELEV	AREA	V AVG	DELTA V**2/2G	OUTPUT MESSAGE
0.0	-400.	414.	203.	97.	514.	814.	102.4	9075.	2.24		SURVEY DATA EXCEEDED
0.1	-359.	319.	162.		419.	678.	102.5	8540.	2.38	0.01	
0.4	-335.	283.	138.		383.	618.	102.8	8255.	2.46	0.02	
1.0	-309.	236.	112.		336.	545.	103.4	7851.	2.59	0.03	

SECTION 92397

CHANNEL BANKS AT STATIONS -296. AND -205. DISCHARGE= 20318. CFS

STAGE	FLOODWAY STA LEFT	FLOODWAY STA RIGHT	WIDTHS IN FT. LEFT	WIDTHS IN FT. CHANNEL	WIDTHS IN FT. RIGHT	TOTAL	ELEV	AREA	V AVG	DELTA V**2/2G	OUTPUT MESSAGE
0.0	-296.	213.	0.	91.	418.	509.	102.8	4716.	4.31		SURVEY DATA EXCEEDED
0.1	-296.	70.	0.		275.	366.	102.9	4233.	4.80	0.07	
0.4	-296.	7.	0.		212.	303.	103.2	3974.	5.11	0.12	
1.0	-296.	-50.	0.		155.	246.	103.8	3700.	5.49	0.18	

Exhibit 4.--Continued.

FLOWY REV 12/01/77
XEQ 04/05/78

YANTIC RIVER WS 4TH PROFILE (USES WSP2 TR-61 TEST DECK)

SECTION 92100

CHANNEL BANKS AT STATIONS -218. AND -48. DISCHARGE= 20308. CFS

STAGE	FLOODWAY STA LEFT	FLOODWAY STA RIGHT	WIDTHS IN FT. LEFT	WIDTHS IN FT. CHANNEL	WIDTHS IN FT. RIGHT	TOTAL	ELEV	AREA	V AVG	DELTA V**2/2G	OUTPUT MESSAGE
0.0	-260.	27.	42.	170.	75.	287.	102.5	1566.	12.96		
0.1	-242.	-48.	24.		0.	194.	102.6	1404.	14.46	0.64	NO KD IN RIGHT F.P.
0.4	-218.	-48.	0.		0.	170.	102.9	1344.	15.11	0.94	FLOW IN CHANNEL W/O FRI(
1.0	-218.	-48.	0.		0.	170.	103.5	1446.	14.04	0.45	FLOW IN CHANNEL

SECTION 90963

CHANNEL BANKS AT STATIONS 0. AND 100. DISCHARGE= 20286. CFS

STAGE	FLOODWAY STA LEFT	FLOODWAY STA RIGHT	WIDTHS IN FT. LEFT	WIDTHS IN FT. CHANNEL	WIDTHS IN FT. RIGHT	TOTAL	ELEV	AREA	V AVG	DELTA V**2/2G	OUTPUT MESSAGE
0.0	-534.	130.	534.	100.	30.	664.	106.3	6443.	3.15		
0.1	-373.	115.	373.		15.	488.	106.4	5840.	3.47	0.03	
0.4	-341.	106.	341.		6.	447.	106.7	5654.	3.59	0.05	
1.0	-283.	100.	283.		0.	383.	107.3	5317.	3.82	0.07	NO KD IN RIGHT F.P.

SECTION T1S1

CHANNEL BANKS AT STATIONS -96. AND -5. DISCHARGE= 78900. CFS

STAGE	FLOODWAY STA LEFT	FLOODWAY STA RIGHT	WIDTHS IN FT. LEFT	WIDTHS IN FT. CHANNEL	WIDTHS IN FT. RIGHT	TOTAL	ELEV	AREA	V AVG	DELTA V**2/2G	OUTPUT MESSAGE
0.0	-96.	413.	0.	91.	418.	509.	102.6	4608.	17.12C		SURVEY DATA EXCEEDED
0.1	-96.	254.	0.		259.	350.	102.7	4077.	19.35	1.26	
0.4	-96.	197.	0.		202.	293.	103.0	3841.	20.54	2.00	
1.0	-96.	144.	0.		149.	240.	103.6	3592.	21.96C	2.94	

Exhibit 4.--Continued.

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FLOWY REV 12/01/77
      XEQ 04/05/78

INPUT DATA USED IN FLOWY COMPUTATIONS

FLOWY     WSP2
TITLE     YANTIC RIVER WS 4TH PROFILE  (USES WSP2 TR-61 TEST DECK)
OPTION     YES                0.1  0.4  1.0
DDSECTION  93600      102       20363
DDSECTION  93147      102.4     20338
DDSECTION  92397      102.8     20318
DDSECTION  92100      102.5     20308
DDSECTION  90963      106.3     20286
DDSECTION  T1S1       102.6     78900    1
SECTION    93600
           -750.      105.      -720.     100.      -490.     96.
           -415.      96.       -335.     95.       -165.     87.5
           -150.      82.       -110.     81.       -82.      81.7
            -62.      84.        -50.     89.       100.      95.0
            530.      95.       660.      105.
ENDTABLE
SEGMENT    93600      1         D         -165.
NVALUE     0.050
SEGMENT    93600      2         C         -50.
NVALUE     0.040
SEGMENT    93600      3         D         660.
NVALUE     0.050
SECTION    93147
           -400.      100.      -310.     92.4      -274.     92.5
           -257.      91.       -215.     89.9      -197.     87.8
           -128.      82.5      -107.     84.7      -100.     90.8
           -194.      82.5      -177.     81.8      -155.     81.6
            -92.      90.8       -85.     87.5       -72.     86.8
            -42.      87.0       -24.     88.2       -10.     88.7
              0.      90.3        83.     90.0        90.     90.9
            263.      92.3       370.     97.3       465.     108.3
            465.      115.
ENDTABLE
SEGMENT    93147      1         D         -197.
NVALUE     0.065
SEGMENT    93147      2         C         -100.     90.8
NVALUE     0.040
SEGMENT    93147      3         D         465.      115.
NVALUE     0.060
SECTION    92397
           -296.      95.2      -274.     85.3      -269.     84.2
           -241.      83.7      -218.     84.2      -214.     85.5
           -205.      89.1      -160.     89.2       -94.     90.3
            -53.      95.0       103.     99.0       118.     99.5
            213.      99.2
ENDTABLE
SEGMENT    92397      1         C         -205.
NVALUE     0.040
SEGMENT    92397      2         D         213.
NVALUE     0.045
```

Exhibit 4.--Continued.

```
FLOWY REV 12/01/77
      XEQ 04/05/78

INPUT DATA USED IN FLOWY COMPUTATIONS

SECTION    92100
           -260.      115.0     -260.     98.4      -218.     97.8
           -213.      96.0      -198.     94.6       -48.     95.2
            -48.      99.5       -40.     99.5       -40.     101.3
             -7.      101.3       12.     101.0       25.     101.6
             40.      109.0
ENDTABLE
SEGMENT    92100      1         D         -218.
NVALUE     0.045
SEGMENT    92100      2         C         -48.
NVALUE     0.015
SEGMENT    92100      3         D         40.
NVALUE     0.045
SECTION    90963
           -475.      103.      -460.     101.9     -420.     102.4
           -380.      98.4      -250.     97.4      -110.     97.4
              0.      97.8         8.     94.2       -25.     85.5
             60.      85.5       100.     85.5       100.     96.5
            142.      110.      -600.     110.
ENDTABLE
SEGMENT    90963      1         D         0.
NVALUE     0.055
SEGMENT    90963      2         C         100.      96.5
NVALUE     0.040
SEGMENT    90963      3         D         142.
NVALUE     0.055
SECTION    T1S1
           -96.       95.2      -74.      85.3      -69.      84.2
           -47.       83.7      -25.      84.2      -14.      85.5
            -5.       89.1       40.      89.2       106.     90.3
           147.       95.0       303.     99.0       318.     99.5
           413.       99.2
ENDTABLE
SEGMENT    T1S1       1         C         -5
NVALUE     0.040
SEGMENT    T1S1       2         D         413
NVALUE     0.045


 END OF FLOWY JOB.
```

Exhibit 4.--Continued.

* U. S. GOVERNMENT PRINTING OFFICE : 1978 261-504/94